# AN APPARATUS FOR REGULATING COMPONENTS OF ROTARY MACHINES FOR DECORATION OF CERAMIC TILES

## BACKGROUND of the INVENTION.

Specifically, though not exclusively, the invention is usefully applied in rotary machines of the type in which a matrix-bearing cylinder, mobile in rotation about an axis thereof, operates on a mobile rest plane on which tiles are translated in a predetermined direction, with at least one doctor predisposed to operate in contact with the external surface of the cylinder.

In the present example the matrix-bearing cylinder is provided with at least one elastically-deformable peripheral part limited by a smooth external cylindrical surface made of an elastomer material on which a shape is recessed, constituting the matrix.

In known machines of this type the doctor is in a fixed position with respect to the cylinder, while the doctor-cylinder group is mobile and adjustable with respect to the mobile rest plane of the tiles.

This constitutes a big limitation because each prior-art rotary machine is by its nature only able to use matrix-bearing cylinders of identical diameters.

A further problem is the adjustment of the doctor with respect to the surface of the matrix-bearing cylinder.

A further problem in known machines is continuously measuring and controlling the pressure of the doctor against the external surface of the cylinder during the work cycle.

A further problem, connected to the above-cited drawbacks, is the dismounting and subsequent remounting of the doctor, simply and rapidly and without having each time to perform laborious adjustment and set-up

operations.

The main aim of the present invention is to obviate the limitations and drawbacks of the prior art and to provide a simple and effective solution to them.

An advantage of the invention is that it presents a structure allowing easy remote control, without having to perform operations in proximity of the machine.

These aims and advantages and others besides are all achieved by the present invention, as it is characterized in the appended claims.

**SUMMARY of the INVENTION.**

On a mobile rest plane on which tiles are translated in a predetermined direction, the following operate: a matrix-bearing cylinder, mobile in rotation about an axis thereof, and at least a doctor predisposed to operate contactingly with an external surface of the cylinder. The apparatus comprises: a vertically-developing frame; a first slide constrained on the vertical frame and slidable vertically with respect thereto; the matrix-bearing cylinder being supported on the first slide, together with organs for supporting the matrix-bearing cylinder and organs for controlling rotation thereof about a rotation axis thereof; a second slide, with at least one doctor being supported thereon, together with organs for supporting the doctor and organs for controlling movements thereof, is constrained on the frame and can slide vertically with respect thereto. An electrically-activated maneuvering screw produces relative positioning of the first slide and the second slide and positioning of the slides with respect to the vertically-developing frame.

**BRIEF DESCRIPTION of the DRAWINGS.**

Further characteristics and advantages of the present invention will better

emerge from the detailed description that follows, of a preferred but non-limiting example of the invention, in a preferred but non-exclusive embodiment thereof, illustrated by way of example in the accompanying figures of the drawings, in which:

figure 1 is a schematic front view in vertical elevation;

figure 2 is a schematic lateral view from the left of figure 1;

figure 3 is a schematic view from above of figure 2;

figure 4 is a schematic lateral view from the left of figure 2.

**DESCRIPTION of the PREFERRED EMBODIMENTS.**

With reference to the figures of the drawings, 1 denotes in its entirety a vertical frame of a rotary machine for decoration of ceramic tiles, of a type in which tiles are translated in a predetermined direction on a mobile rest plane 16, on which a matrix-bearing cylinder 3 operates, which cylinder 3 is rotatingly mobile about an axis thereof, with at least one doctor being predisposed to operate contactingly on the external surface of the matrix-bearing cylinder 3. The cylinder 3 is provided with at least one elastically-deformable peripheral part delimited by a smooth external cylindrical surface, made of an elastomer material and on which a shape has been cut, or recessed; this is the matrix.

A first slide 2 is constrained on the frame 1 and slides in a vertical direction; the matrix-bearing cylinder 3 is supported on the first slide 2 together with the organs supporting the cylinder 3 and rotating it about an axis thereof. In particular, rotation drive is transmitted to the cylinder 3 by a brushless motor, not included in the figures of the drawings.

A step motor 30 driven by a cogged belt transmission 31 centers the cylinder 3 on the transit axis of the tiles moving on the mobile rest plane 16.

A second slide 4 is constrained to the frame 1 above the first slide 2, and

slides vertically thereto. The second slide 4 supports at least one doctor 5 together with the organs supporting and moving the doctor 5.

The relative positioning with respect to the vertical frame 1 and therefore with respect to the mobile rest plane 16, of the first slide 2 and the cylinder 3 and the second slide 4, and consequently also the doctor 5, is done by simple electronically-controlled electromechanical means.

The electronically-controlled electromechanical means comprise: a vertical-axis maneuvering screw 6 on which a first nut 7 is coupled, which first nut 7 is solidly constrained to the first slide 2, and a second nut 8 which is coupled solidly in translation along the rotation axis to the second slide 4, and rotatable with respect thereto about the common axis.

The maneuvering screw 6 is rotated by predetermined amounts about the axis thereof by a first step motor 9. Transmission of drive is effected by a belt transmission 10.

The second nut 8 is made to rotate by predetermined amounts about an axis thereof and thus with respect to the second slide 4, by a second step motor 11 which is solidly constrained to the second slide 4 by a belt transmission 12.

This configuration allows displacements of predetermined entities (position adjustment) in a vertical direction, i.e. parallel to the axis of the maneuvering screw 6, of the whole second slide 4, and thus of the doctor 5 supported thereon, independently of the activating of the maneuvering screw itself. It is thus possible to make a fine adjustment of the distance between the doctor 5 and the matrix-bearing cylinder 3. This also enables a variation in the inclination of the doctor 5 with respect to the external cylindrical surface of the matrix-bearing cylinder 3.

The doctor 5 is mounted removably on the shaft 50 which is connected to the second slide 4 and is positioned parallel to the rotation axis of the cylinder 3.

In particular, the shaft 50 is coaxially supported in a sleeve 51 which is solidly constrained to the second slide 4, to which are connected means for controlling the adjustment of the inclination of the doctor 5 and for controlling the pressure of the doctor 5 against the external surface of the matrix-bearing cylinder 3.

The means for controlling comprise a linear actuator 13 which operates in both directions between the body of the second slide 4 and the second end of a lever 52, a first end of which is solidly constrained in rotation with the shaft 50, and a measuring device 15, also operating between the body of the second slide 4 and the second end of the lever 52 for measuring displacements with respect to a prefixed reference, and, consequently, to measure inclinations with respect to the vertical.

The linear actuator 13 is constituted by a screw-jack actuated by a gear reducer controlled by a step motor; the jack operates in connection with a force-measuring device 14 which measures the total force exerted by the jack on the lever 52. Obviously the measure of the force read directly and instantaneously indicates the value of the pressure with which the doctor 5 presses on the external cylindrical surface of the matrix-bearing cylinder 3. Knowing instantaneously the pressure effectively exerted by the doctor 5 on the external cylindrical surface of the matrix-bearing cylinder 3 allows a fine adjustment of the pressure moment by moment and completely automatically, apart from, obviously, enabling a perfect setting-up of the system in line with the sought-for result.

The presence of the measuring device 15 means that the inclination can also be measured moment by moment, with the consequent possibility of acting, for example by adjusting the distance between the second slide 4 and the first slide 2.

Different embodiments of the linear actuator 13 are possible, and of the measuring device connected there-to, for carrying out the function as described. In particular purely electrical or electrical-hydraulic actuators can be used, where, for example, the measurement of the force applied is obtained by direct measurement of the pressure of a fluid.

With the above-described apparatus the adjustment of the positions with respect to the mobile rest plane 16 of the cylinder 3 and the doctor 5 can be performed, as well as the adjustment of the relative position of the inclination and the pressure with which the doctor 5 acts contactingly with the matrix-bearing cylinder 3.

Automated control of all adjustment operations is very simply and directly achieved. In particular, for example, any adjustment can be stored to be re-used and recalled when necessary (for example, when changing single set-ups or changing the diameter of the matrix-bearing roller).

A device for controlledly imparting oscillating motion to the doctor 5 is supported on the second slide 4.

The oscillating motion is actually imparted on the shaft 5 supporting the doctor 5.

The shaft 50 is supported by a free coupling in the sleeve 51 and is coupled to the lever 52 solidly in rotation, but slidable axially. The shaft 50 also exhibits an end affording a slot 53 internally of which a cam pivot 54 engages, which pivot 54 is solidly constrained to a shaft 48. The shaft 48 rotates, on command, about an axis which is perpendicular to the axis of the shaft 50, by a step motor 56 via a belt transmission 55. The movement of the cam pivot 54 in the slot 53 produces, as a result, an alternating oscillating motion of the shaft 50 with respect to the sleeve 51 and the lever 52. This motion is solidly transmitted to the doctor 5.

The doctor is fixed to a support frame 57 provided with coaxial housings 58 internally of which the shaft 50 can be snugly coupled. The shaft 50 is also provided with a transversal hollow seating 59, which receives, in a stable coupling, a pivot 60 mounted eccentrically on the support frame 57, which pivot 60 is activated by a lever 49 so that it can pass from the stable coupled position with the hollow seating 59 to a completely uncoupled position in which the shaft 50 is free internally of the coaxial housings 58.

In particular, the hollow seating 59 is constituted by a portion of surface of straight circular cylinder. The pivot 60 exhibits an external diameter which is the same as the diameter of the portion of surface of the straight circular cylinder delimiting the hollow seating 59.

The above-described arrangement enables an extremely rapid coupling and uncoupling of the doctor 5 on and from the shaft 50 and on and from the machine.

The above coupling and uncoupling operations of the doctor 5 do not require any special operations or the need to perform adjustments to correctly position the doctor 5, because the coupling of the pivot 60 in the hollow seating 59 ensures an automatic and perfect centering of the doctor 5 on the shaft 50 and therefore a perfect positioning of the doctor 5 with one simple maneuver only.